

WHAT IS CLAIMED IS:

1 1. A process for realizing microchannels buried in an integrated structure comprising
2 a monocrystalline silicon substrate, comprising:
3 forming in said substrate at least a trench; and
4 obtaining said microchannels starting from a deep cavity characterized by a small
5 surface port obtained through anisotropic etching of said at least one trench, said microchannels
6 being nearly entirely buried in said substrate in a completely monocrystalline structure.

1 2. The process according to claim 1:
2 wherein forming comprises:
3 depositing a mask above said substrate;
4 opening of windows having a convenient width; and
5 plasma etching which uses said mask to form said trenches having side
6 walls being essentially orthogonal to the surface of said substrate; and
7 wherein obtaining comprises:
8 wet anisotropic etching to form, starting from said trenches, said
9 microchannels, said anisotropic etching step providing different etching speeds due to different
10 atom coordination.

1 3. The process according to claim 2, wherein plasma etching is performed with a
2 TMAH or KOH solution.

1 4. The process according to claim 2, wherein opening the windows having a
2 convenient width is performed through photolithography and subsequent plasma etching.

1 5. The process according to claim 2, wherein deposition of a mask above said
2 substrate comprises a silicon nitride deposition through the CVD deposition.

1 6. The process according to claim 2, wherein deposition of a mask above said
2 substrate comprises a heavily doped monocrystalline layer deposition.

1 7. The process according to claim 6, wherein the heavily doped monocrystalline
2 layer has a dopant concentration higher than 10^{19} atoms/cm³.

1 8. The process according to claim 1, further comprising a convenient epitaxial new
2 growing operation effective to close an upper part of said microchannels and completely bury the
3 microchannels in monocrystalline silicon.

1 9. The process according to claim 1, further comprising an oxide, polysilicon or
2 nitride deposition effective to close an upper part of said microchannels and completely bury the
3 microchannels.

1 10. The process according to claim 1, wherein the wet anisotropic etching step turns
2 said side walls of said trenches into a pair of rotated v-grooves orthogonal to a surface of said
3 substrate and defining rombohedral-shaped microchannels.

1 11. The process according to claim 1, further comprising depositing a layer of
2 material having a low etching speed.

1 12. The process according to claim 11, further comprising plasma etching effective to
2 open a region at a trench base.

1 13. The process according to claim 11, further comprising removing of said layer and
2 in an etching of said substrate in a lower part of said trenches before said plasma etching step.

1 14. An integrated structure, comprising:
2 at least a monocrystalline silicon substrate wherein at least one microchannel is
3 formed which is nearly entirely buried inside said substrate.

1 15. The integrated structure according to claim 14, wherein the microchannel has a
2 generally rhombohedral cross-sectional shape.

1 16. The integrated structure according to claim 14, further comprising an epitaxially
2 grown silicon layer above the silicon substrate to completely enclose the microchannel in
3 monocrystalline silicon.

1 17. The integrated structure according to claim 14, further comprising a layer above
2 the silicon substrate to close completely enclose the microchannel.

1 18. The integrated structure according to claim 17, wherein the layer is an oxide,
2 polysilicon or nitride deposition effective to close an upper part of said microchannel and
3 completely bury the microchannel.

1 19. A method for forming microchannels, comprising:
2 forming a narrow elongated trench in a monocrystalline silicon substrate;
3 performing an anisotropic wet etch of the narrow elongated trench to form a
4 microchannel structure having a generally rhombohedral cross-sectional shape with a top port
5 substrate surface opening; and
6 closing the top port substrate surface opening of the microchannel structure to
7 entirely enclose the microchannel structure.

1 20. The method of claim 19 wherein closing comprises epitaxially growing
2 monocrystalline silicon on a surface of the substrate to entirely enclose the microchannel
3 structure in monocrystalline silicon.

1 21. The method of claim 19 wherein the anisotropic wet etch is made using a TMAH
2 solution.

1 22. The method of claim 19 wherein the anisotropic wet etch is made using a KHOH
2 solution.

1 23. The method of claim 19 wherein forming comprises defining a mask with an
2 opening therein at the location of the trench and plasma etching through the mask opening to form
3 the narrow elongated trench.

1 24. The method of claim 19 wherein the narrow elongated trench has a width at the
2 surface of the substrate of about 1 micrometer.

1 25. The method of claim 24 wherein the narrow elongated trench has a depth from the
2 surface of the substrate of about 9 micrometers.

1 26. The method of claim 19 wherein closing comprises depositing a layer of material
2 to close the top port substrate surface opening.

1 27. The method of claim 26 wherein layer of material is a material taken from the
2 group consisting of a polysilicon, a nitride or an oxide.

1 28. A method for forming microchannels, comprising:
2 forming a monocrystalline silicon layer over a monocrystalline silicon substrate;
3 forming a narrow elongated trench through the monocrystalline layer and into the
4 monocrystalline silicon substrate;
5 performing an etching of a base region of the narrow elongated trench to form a
6 microchannel structure having a top port opening; and
7 closing the top port opening of the microchannel structure to entirely enclose the
8 microchannel structure.

1 29. The method of claim 28 wherein closing comprises growing monocrystalline
2 silicon to close the top port opening in trench above the formed microchannel structure and
3 produce the microchannel structure enclosed completely in monocrystalline silicon.

1 30. The method of claim 28 wherein performing comprises anisotropically wet
2 etching the base region to define the microchannel structure with a generally rhombohedral
3 cross-sectional shape.

1 31. The method of claim 30 wherein the anisotropic wet etch is made using a TMAH
2 solution.

1 32. The method of claim 30 wherein the anisotropic wet etch is made using a KHOH
2 solution.

1 33. The method of claim 28 wherein forming the narrow elongated trench comprises
2 defining a mask with an opening therein at the location of the trench and plasma etching through
3 the mask opening to form the narrow elongated trench.

1 34. The method of claim 28 wherein closing comprises depositing a layer of material
2 to close the top port opening.

1 35. The method of claim 34 wherein layer of material is a material taken from the
2 group consisting of a polysilicon, a nitride or an oxide.